



Extracranial internal carotid artery vasospasm during thrombectomy

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Abstract

The use of a stent retriever increases the risk of intracranial vasospasm. Here, we report the case of a man who developed severe vasospasm in a long segment of the extracranial internal carotid artery after mechanical irritation by a stent retriever inserted for the treatment of acute cerebral ischemia. A 47-year-old right-handed man presented with sudden-onset right-sided weakness and difficulty speaking. The patient's National Institutes of Health Stroke Scale score was 6 and he had an Alberta Stroke Program Early Computed Tomography Score of 9. The patient was started on intravenous alteplase therapy, and an acute thrombectomy was performed. Left internal carotid digital subtraction angiography showed narrowing of the left common and internal carotid arteries and occlusion of the proximal left M1 segment of the middle cerebral artery. A stent retriever was retracted into a guiding catheter placed at the left carotid bulb under continuous suction. Recanalization of the middle cerebral artery was not achieved and there was significant narrowing in a long segment of the extracranial internal carotid artery associated with exacerbation of the patient's aphasia. The cervical vasospasm improved after nicardipine infusion via the catheter. We encountered vasospasm in a long segment of the extracranial internal carotid artery after mechanical irritation by a stent retriever. If a stent retriever is used in a patient with a narrow extracranial internal carotid artery, consideration should be given to using a Penumbra or smaller guiding catheter located in the distal internal carotid artery to prevent irritation to the cervical vessel wall.

Keywords

Carotid artery vasospasm, stent retriever, thrombectomy

Introduction

Recent efficacy studies of modern stent retrieval devices such as the Solitaire FR (Covidien Ltd, Dublin, Ireland) and Trevo ProVue (Stryker Corp., Kalamazoo, MI, USA) have shown promising results for the treatment of acute ischemic stroke.^{1,2} However, the use of these devices is associated with the risk of procedure-related complications such as embolization to a new territory, vessel dissection, and intracranial vasospasm.³ In the Endovascular Revascularization With Solitaire Device Versus Best Medical Therapy in Anterior Circulation Stroke Within 8 Hours (REVASCAT) study, 14 of 103 patients in the intervention group experienced vasospasm.^{4,5} Similarly, Kuntze Söderqvist et al. reported a vasospasm rate of 11.3% (17 of 151 patients) after stent retriever use.⁶ Severe vasospasm after mechanical thrombectomy is a potential cause of poor recanalization,⁷ and most of these intracranial artery vasospasms are focal. To the best of our knowledge, no study to date has reported vasospasm in a long segment of the extracranial internal carotid artery (ICA) after mechanical thrombectomy. Here, we report the case of a man who experienced

vasospasm in a long segment of the extracranial ICA caused by mechanical irritation from a stent retriever. Additionally, we discuss procedures for preventing extracranial vasospasm.

Case report

A 47-year-old right-handed man presented with sudden-onset right-sided weakness and difficulty speaking and was transferred to our hospital 38 minutes after symptom onset. The patient had no significant medical history including hypertension, hyperlipidemia and diabetes, and he was a non-smoker. He weighed 72 kg and was 187 cm tall. The patient's blood pressure was 148/78 mmHg, and he was in sinus rhythm. He had no

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headache, back pain, or evidence of an aortic dissection. Neurological examinations revealed left hemiparesis with a National Institutes of Health Stroke Scale (NIHSS) score of 6. All laboratory findings were normal. Brain magnetic resonance imaging (MRI) revealed high signal intensity in the left middle cerebral artery (MCA) territory mainly in the putamen and corona radiata on diffusion-weighted imaging (Figure 1). The patient's Alberta Stroke Program Early Computed Tomography Score was 9. Fluid-attenuated inversion recovery (FLAIR) imaging demonstrated no abnormal signal. Magnetic resonance angiography showed occlusion of the proximal portion of the left MCA (Figure 1). Thus, we diagnosed the patient with acute cerebral occlusion, began an intravenous infusion of alteplase (0.6 mg/kg), and performed an emergent thrombectomy.

A 9 Fr sheath introducer (Medikit Co., Ltd., Tokyo, Japan) was inserted into the right femoral artery under local anesthesia with a door-to-puncture time of 45 minutes. The digital subtraction angiography (DSA) showed narrowing of the patient's left common carotid artery and ICA (Figure 2). When a 9 Fr Cello balloon-guide catheter (Covidien Ltd) was placed in the left ICA, the guide catheter became wedged, and a slight extracranial ICA vasospasm occurred (Figure 2), so we moved it to the left carotid bulb. Left ICA DSA showed occlusion of the proximal left M1 segment of the middle cerebral artery (MCA) (Figure 3). The flow of the anterior cerebral artery (ACA) developed and perfused the MCA territory. First, a Penumbra 5MAX ACE catheter (Penumbra Inc, Alameda, CA, USA) was delivered and positioned immediately adjacent to the occlusion site using an Excelsior XT-27 microcatheter (Stryker Corp.) and a 0.014-inch CHIKAI microguidewire (Asahi Intecc, Nagoya, Japan). We then removed the microcatheter and wire. Aspiration was achieved using a Penumbra aspiration pump (Penumbra Inc). After inflating the guiding catheter balloon, aspiration was performed via the guiding

catheter using a 20 ml syringe. The 5MAX ACE catheter was then slowly withdrawn while maintaining negative pressure (i.e. the direct aspiration first-pass technique). This procedure failed to recanalize the occluded MCA. Next, an Excelsior XT-27 microcatheter was placed distal to the site of occlusion using a 0.014-inch CHIKAI microguidewire. The presence of the microcatheter tip in the true lumen and the absence of distal embolism were confirmed. A 4mm Trevo ProVue stent retrieval device (Stryker Corp.) was deployed at the site of the thrombus, and MCA flow



Figure 2. Left internal carotid digital subtraction angiography showing narrowing of the left common carotid and internal carotid arteries (left). The guide catheter positioned in the internal carotid artery is wedged and a slight extracranial vasospasm is present (right).

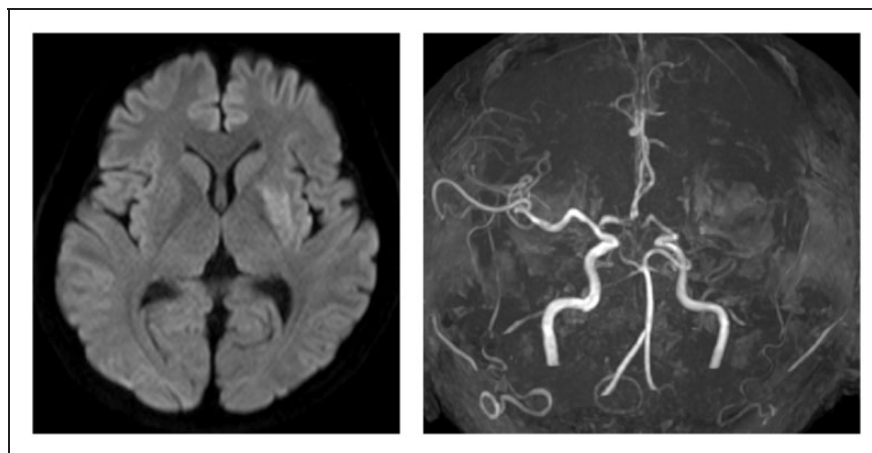


Figure 1. Preoperative imaging. Diffusion-weighted magnetic resonance imaging showing acute infarction of the left putamen (left). Magnetic resonance angiography showing occlusion of the left middle cerebral artery (right).

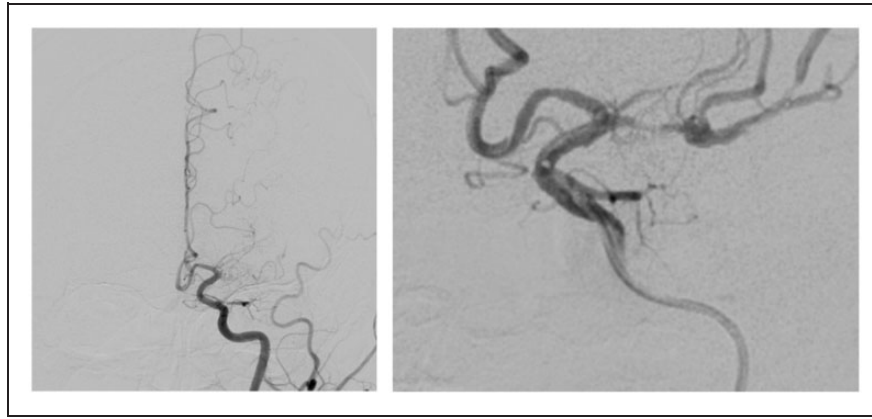


Figure 3. Left internal carotid digital subtraction angiography showing occlusion of the proximal left M1 segment of the middle cerebral artery (left) and partial flow restoration in the vessel after deployment of a stent retriever (right).

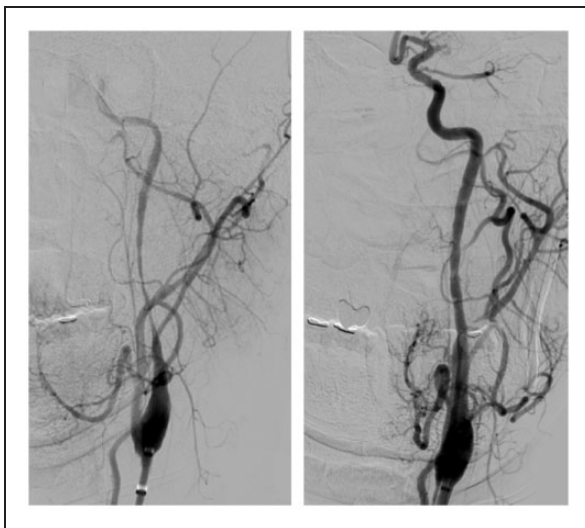


Figure 4. Post-thrombectomy left internal carotid digital subtraction angiography showing significant narrowing of the left internal carotid artery from the cervical petrous portion to its origin (left) and marked improvement after infusion of 2 mg of nicardipine in the narrowed region (right).

restoration was performed (Figure 3). Five minutes later, the stent retriever was retracted into the guiding catheter in the left carotid bulb under continuous suction after inflation of the guiding catheter balloon. We confirmed that the position of the guide catheter balloon did not change during the procedure. The patient reported a headache during this portion of the procedure, and again we failed to recanalize the MCA. Additionally, we observed significant ICA narrowing from the proximal part of the cervical petrous portion to its origin (Figure 4), and the patient's aphasia worsened 25 minutes after puncture. The collateral flow of left ACA perfusing the left MCA territory was stopped because of significant ICA narrowing. Therefore, we infused 2 mg of nicardipine through the guiding catheter over a period of 10 minutes. This treatment improved the severe extracranial ICA vasospasm,

and the patient recovered his preoperative neurological status (Figure 4).

Postoperatively, the patient's neurological symptoms were stable. MRI performed on postoperative day (POD) one demonstrated no extension of the infarction. Atrial fibrillation or other cardiac sources of embolism were not detected. After an uneventful postoperative course, he was transferred to another hospital for rehabilitation on POD seven with a modified Rankin Score of 2.

The patient provided written informed consent for the publication of this case and the associated images.

Discussion

In this case, we documented vasospasm occurring in a long segment of the extracranial ICA after mechanical thrombectomy. Mechanically induced extracranial ICA vasospasm often occurs during insertion of a guiding catheter.⁸ The guiding catheter is usually placed in the distal ICA (e.g. in the proximal petrous portion) during a thrombectomy. Although we placed a 9 Fr Cello balloon guide catheter in the left ICA, the guide catheter became wedged, and a slight extracranial ICA vasospasm occurred because the vessel was narrow. Therefore, we placed the guiding catheter in the left carotid bulb during the thrombectomy. Retrospectively, if the guiding catheter had been placed in the distal ICA, the stent retriever would not have irritated the cervical vessel wall, and the extracranial ICA vasospasm would not have occurred. However, we had to consider the possibility of guiding catheter-induced vasospasm and cervical dissection. In this case, before using the stent retriever, we tried to perform the thrombectomy using a Penumbra 5MAX ACE catheter. This procedure did not induce vasospasm and may be safer in this setting. A stent retriever should probably be stored in a Penumbra 5MAX ACE placed in the distal ICA to prevent vasospasm in patients with a narrow ICA. Use of a smaller guiding catheter may be one option for decreasing the risk

of guiding catheter-induced vasospasm. In the present case, the diameter of the left ICA was approximately 3.4 mm on DSA (Figure 2), whereas the diameter of the stent retriever was 4.0 mm. Passage of a larger retrieval device through the narrow extracranial ICA likely caused vasospasm. Alternatively, the use of a 3.0 mm Baby Trevo retrieval device (Striker Corp.) may be useful for preventing vessel wall irritation if the guiding catheter is placed in the proximal ICA.

In conclusion, we describe a case of severe vasospasm in a long segment of the extracranial ICA caused by mechanical irritation from a stent retriever inserted to treat acute cerebral ischemia secondary to left MCA occlusion. To minimize irritation to the cervical vessel wall, consideration should be given to performing procedures early storing in a Penumbra 5MAX ACE or smaller a guiding catheter located in the distal ICA if a stent retriever is used in a patient with a narrow extracranial ICA.

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Conflict of interest

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